

REMARKS

Claims 1-11 are pending. Claim 12 has been cancelled herein without prejudice in compliance with the Restriction Requirement of November 18, 2003.

Applicants' Response to Rejections Under 35 U.S.C. §112, First Paragraph

Claims 2 and 8-11 stand rejected under 35 U.S.C. §112, first paragraph, as failing to comply with the enablement requirement. Applicants respectfully submit that the present invention is enabled within the meaning of §112, first paragraph. As will be explained below, the present invention does have proper conductivity despite the teachings of Sakuyama et al.

The metal paste and particles of the two inventions serve different purposes and therefore have different compositions. The metal paste, 140 of Sakuyama et al. is the sole electrical connection between the electrodes 111 and 121 (see col. 10, lines 41-55 and Figs. Id and Ie). As such, the metal content needs to be high to ensure a good electrical connection between the electrodes.

However, the present invention utilizes metal grains 116 suspended in a flux paste 115A. The metal grains 116 are not the sole electrical connections between electrodes. The present invention utilizes solder bumps 112 (projection electrodes) to connect to the

connection terminal 114. The purpose of the metal grains 116 is to ensure the connectivity of the electrodes 112 and 114 by forming a conductivity bridge between the solder bump and terminal, when such a solder bump is shorter 112B than related solder bumps 112A (ΔH) (see page 18, line 29 to page 19, line 10 and Fig. 5).

The formation methods of the two metal pastes and metal grains are different. Sakuyama et al. discloses that the metal paste 140 is specifically positioned between the electrodes (see col. 9, lines 42-49 and Fig. 1 C). On the other hand, the present invention teaches that the flux paste 115A and metal grains 116 are positioned across the surface of the mounting substrate 113 (see page 14, lines 26-27 and Figs. 3A and 4).

The present invention according to claims 2 and 8 has the feature that the metal grains included in flux pastes have diameters larger than the tolerance ΔH of the diameters of the projection electrodes and less than one third the diameters of the projection electrodes and the ratio to the flux paste is 1 to 20%. Since the diameters of the metal grains are set as described above, the projection electrodes are stably joined on a substrate even if there is a variation of the projection electrodes (line 22 of page 8 to line 16 of page 9). In general, the flux paste includes the metal grains at 50% volume. However, when the content of the metal grains is suppressed at 1 to 20% volume, it is possible to prevent a bridge between adjacent bumps.

If the diameters of the metal grains are more than one third the diameter of the projection electrode and the metal grains are greater than 20% volume, adjacent projection electrodes are joined with each other.

Sakuyama (USP 6,670,264 B2) teaches that a content ratio of 30 to 70% volume for electrodes for a chip and a substrate between which a resin is arranged. Also, Sakuyama teaches that a joint cannot be properly conducted if the content ratio is less than 30% volume. However, in the invention of Sakuyama, instead of bumps, the electrodes of the semiconductor chip and the substrate are pasted and joined. Accordingly, the metal grains included in a paste should be great enough to join the electrodes.

Applicants' Response to Rejections Under 35 USC §103(a)

Currently, claims 1-11 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Sakuyama et al. (USP 6,670,264 B2). Applicants respectfully submit that the Sakuyama et al. reference is not prior art within the definition of 35 USC §102. The present application was filed on February 28, 2002. Sakuyama et al. was filed on April 18, 2002.

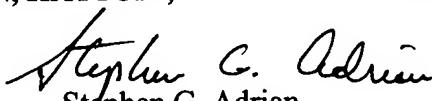
Hence, the present application was filed prior to the §102(e) effective filing date of Sakuyama et al., and therefore Sakuyama et al. is not prior art under 35 U.S.C. §102(e).

Wherefore, based on the above remarks, Applicants respectfully request favorable reconsideration resulting in the removal of the §112 and §103 rejection.

In the event that this paper is not timely filed, Applicant respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,

WESTERMAN, HATTORI, DANIELS & ADRIAN, LLP


Stephen G. Adrian / 
Attorney for Applicant(s)
Reg. No. 32,878
32562

1250 Connecticut Avenue, N.W. Suite 700
Washington, D. C. 20036
202-822-1100 (t)
202-822-1111 (f)